

# Fostering Engagement and Learning in a Forensic Science Course

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**Abstract:** Student engagement is a vital component of education; however, it can be quite challenging to engage a student in the classroom. This work highlights the redesign of an introductory forensic science course in order to understand the factors influencing student engagement and learning. The study visualizes three key modes of interaction for the student: with their course content, with their peers and with the faculty in charge of the course. Analysis of student survey results provided valuable insights into the perceived effectiveness of the three modes of interaction. Students perceived that pedagogical strategies and interactive tools employed in the course were engaging and intellectually stimulating and the faculty encouraged student engagement and showed interest in their learning. They also reported that discussions and group presentations encouraged peer engagement and they enjoyed working as part of a team. In addition, there was a statistically significant increase in actual as well as perceived learning of concepts by the end of the forensic science course. Overall, the positive experience with these modes of interaction will guide faculty and other instructors as they design their courses to achieve student engagement and learning.

**Keywords:** pedagogical strategies, student engagement, student learning, peer engagement, perceived learning

## Introduction

Over the past few years, there has been increasing attention on the conceptualization and measurement of student engagement from researchers as well as policy makers (1-3). Research has shown that student engagement is a multifaceted and complex construct and is associated with improved achievements, persistence and retention (4). An engaged student also understands the value of learning outcomes and can contribute to their own success (5). A student's engagement with academically purposeful activities is an important factor for learning and development in both traditional and technology enhanced learning environments (6). Research has shown that student engagement can be improved by designing learning environments, introducing engaging teaching practices fostering student-centred learning and incorporating engaging course embedded assessments (7, 8). In addition, student interaction with their content, peers and instructors have also resulted in positive correlations with learning outcomes (9). As a result, it becomes imperative for faculty to use a multifaceted pedagogy in the classroom to achieve effective student engagement and learning.

The public appeal of forensic science and the CSI effect on students enrolling in forensic science program has been well documented (10-12). This raises the question of what kind of learning environments and

pedagogical practices engage the student in a forensic science course. Research has shown that student engagement is enhanced when presented with real world connections (8, 13, 14). In fact, there are several studies that document the role of mock crime scenes/virtual crime scenes in improving engagement and learning (15-17). However, in India, forensic science is generally taught in a didactic manner and there is a dearth in studies that focus on pedagogical strategies to foster engagement and learning in the forensic science classroom (18, 19).

The Indian Institute of Science Education and Research (IISER) Tirupati is an institute of national importance established by the Government of India and offers a Bachelor of Science-Master of Science (BS-MS) program in the basic sciences (20). As part of the undergraduate curriculum, an introductory forensic science course is offered as a lecture-based elective in the fall semester. This course covers various topics such as time of death, death investigations, blood, DNA, hair, fibre and fingerprint analysis, crime scene investigation, ballistics, narcotics, toxicology etc. and is a popular elective.

The goal of this study is to understand the pedagogical strategies that can foster student engagement and learning in a face-to-face introductory forensic science course. As a result, this course was redesigned to investigate three different interaction modes for the student: with the content (IC), with their peers (IP) and

with the faculty of the course (IF). Student engagement with content can include any interaction with course material such as textbooks, slides, reference or multimedia instructional material while peer interactions create a dynamic sense of community and can involve group activities and discussion boards (21). Student interaction with instructors can either be in-class or online but is considered vital for their engagement in the course. In addition to engagement, this work also delves into the effect on the actual and perceived student learning in the forensic science course. This study will hopefully provide information to forensic science instructors on designing effective teaching practices to foster student engagement and learning.

## Methods

### *Course information and design*

Forensic Science is an elective course that meets three times a week for an hour each and there is no laboratory component associated with it. The redesigned course format involved three distinct modes of interaction for the students: with their content, their peers and with the faculty in charge of the course.

For achieving student interaction with the content, the author interspersed the conventional lecture time with Mentimeter polls, online quizzes and discussions. All registered students were asked to sign up for a Learning Management System (LMS), Canvas that was set up for the course. This LMS was a one-stop site for all class materials including lectures slides, recorded videos, and reference articles. In order to gauge student understanding of course material, online quizzes were conducted on Canvas on a weekly basis. These quizzes covered topics discussed over the previous week and were moderated live by the instructor.

For achieving interaction with peers and the faculty in charge of the course, the following pedagogical methodologies were adopted. The author used the Socratic method of questioning as a strategy during in-class discussions to encourage critical thinking skills and reflection amongst the students (examples in **Appendix A**) (22). As part of the peer interaction in the course, students were expected to participate in a group presentation. Groups of 2 or 3 students had to choose a forensic case study based on topics related to course content. They were then expected to research the case study and give a twenty-minute PowerPoint presentation on the chosen topic. In addition, they also participated in case studies on the discussion forum on Canvas.

### *Methodology*

This study investigates the role of student interaction with course content, their peers and with the faculty on student engagement and learning. Survey questions for the three modes of interaction were adapted from previous studies (23, 24). The data corresponding to student perspectives on engagement and learning was collected by conducting an online survey for all students of the course at the end of the semester (**Appendix B**). The survey, sent out as a Google form with a two-week response window, was anonymous, voluntary and the students did not receive any credit for participation. It consisted of five-level Likert scale questions, open-ended and closed ended questions. Out of the 52 registered students for the course, 39 students (75%: 77% female and 15% male, 8% preferred not to say) participated in the survey. In order to be compliant with ethical standards in human subject research, Institutional Human Ethics Committee (IHEC) approval was obtained.

### *Assessment of actual and perceived learning*

**Actual Learning:** The students of this introductory course have had no previous forensic science course experience. As a result, conceptual understanding of course material by the students was assessed with a written test that was administered on the first day of class and at the end of the semester. The questions on both of these tests were identical and covered concepts relevant to the course (**Appendix C**). All of the students were encouraged to participate in these assessments. Normalized learning gains were calculated based on Hake (25) in which the average normalized gain ( $g$ ) is defined as the following:  $g = (\% \text{ post-test} - \% \text{ pre-test}) / (100 - \% \text{ pre-test})$ .

**Perceived Learning:** Student perception of learning was measured through a survey with questions relating to their perceived understanding of concepts (**Appendix C**). Perceived learning gains were calculated based on Hake (25) in which the average normalized perceived gain ( $g$ ) is defined as the following:  $g = (\% \text{ post-course} - \% \text{ pre-course}) / (100 - \% \text{ pre-course})$ .

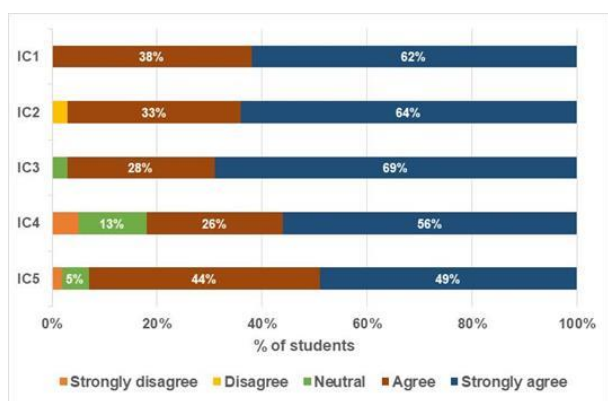
All statistical analyses were carried out with Microsoft Excel and  $t$ -tests were used to calculate the statistical significance for perceived and actual learning.

## Results

### *Interaction with course material (IC)*

Data was collected from Likert scale items and ranged on a 5-point scale from strongly disagree, disagree, neutral, agree, and strongly agree. The first set

of questions involved student perspectives on their engagement with course material. All of the responding students agreed or strongly agreed that the lectures delivered in the course were well organized and interactive (**FIGURE 1: IC1**). A majority of students (97%) also agreed or strongly agreed that in-class pedagogical strategies like Mentimeter polls, online quizzes and discussions were engaging and intellectually stimulating (IC2). Student also perceived that weekly quizzes on the LMS used in this course, Canvas, provided an insight into their understanding of course material (97%) and that Canvas was organized and easy to engage with (82%) (IC3-4). In addition, a majority (93%) agreed that assessments and exams were reflective of course content and helped test their learning and understanding (IC5).



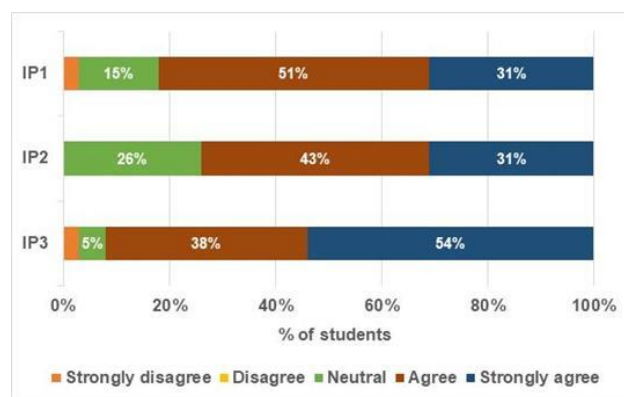
**FIGURE 1** Student perspectives on the role of interaction with their course material (IC) on engagement and learning; *N* = 39. The survey questions were the following: IC1: Lectures were well organized and interactive; IC2: Pedagogical tools like Mentimeter polls, online quizzes and discussions were engaging and intellectually stimulating; IC3: Weekly quizzes on Canvas provided an insight into my understanding of course material; IC4: Course material on Canvas was well organized and easy to engage; and IC5: Assessments and exams were reflective of course material and helped test my learning.

*Interaction with Peers (IP)*

The second set of questions related to student interaction with their peers and its role in their engagement. The course format promoted in-class discussions with the instructor as well as group discussions with their peers. Results reveal that a majority of students (82%) agreed or strongly agreed that in-class discussions encouraged engagement with their peers and fostered critical thinking (**FIGURE 2: IP1**). In addition,

students were encouraged to participate in discussion forums on Canvas. A majority of students (74%) perceived that these discussion forums on Canvas promoted engagement on forensic case studies beyond the classroom (IP2).

As part of the course assessment, students were expected to participate in a group presentation on a forensic case study. Groups of 2-3 students selected a forensic case based on the modules of the course. The students were then expected to research on this case study during the course of the semester and present it to the class. This encouraged peer interaction beyond the confines of the classroom. When asked about the effectiveness of this group presentation in the survey, 92% of students agreed or strongly agreed that they enjoyed working as part of a team for the group presentation (IP3).

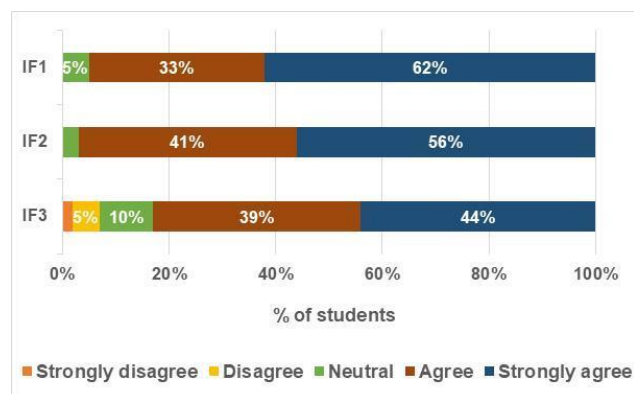


**FIGURE 2** Student perspectives on the role of interaction with their peers (IP) on engagement and learning; *N* = 39. The survey questions were the following: IP1: In-class discussions encouraged engagement with peers and fostered critical thinking; IP2: Online discussion forums promoted engagement in forensic case studies beyond the classroom; IP3: I enjoyed working as part of a team for my group presentation.

*Interaction with Faculty (IF)*

A crucial element in engagement and learning is the interaction between the student and the faculty in charge of the course. The author of this study (faculty in-charge of this course) designed the in-class activities and moderated the discussion (both in-class and on the online forum). In order to understand the role of interaction of the student with the faculty, the third set of questions related to student perceptions on the contribution of the faculty to their course experience. Results reveal that a majority of student agreed or strongly agreed that the faculty was well prepared for the class (95%), encouraged

interactive discussions and student engagement (97%) and showed interest in their learning (83%) (**FIGURE 3: IF1-3**).



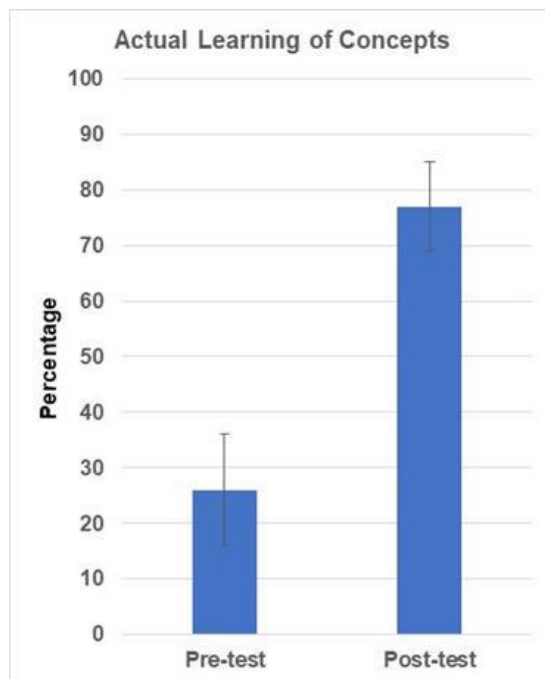
**FIGURE 3** Student perspectives on the role of interaction with the faculty (IF) on engagement and learning;  $N = 39$ . The survey questions were the following: IF1: The faculty was well prepared and explained the material well; IF2: The faculty encouraged interactive discussions and student engagement; IF3: The faculty showed interest in my learning.

#### Student Learning

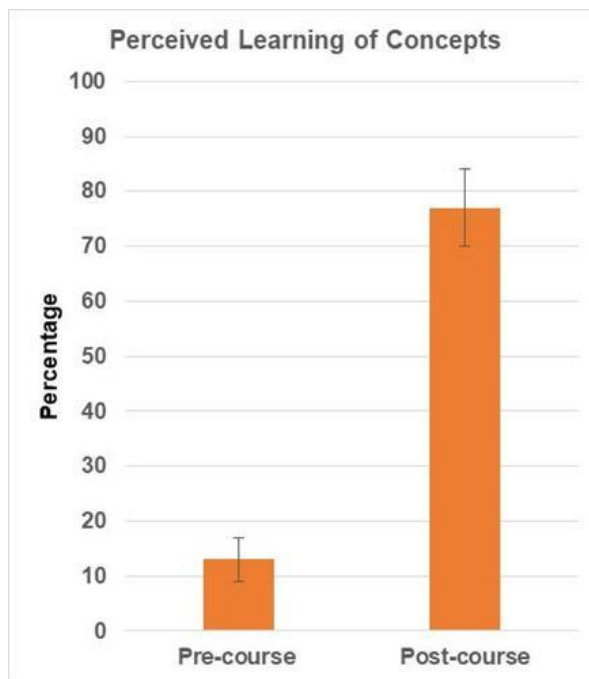
This is an introductory level course tailored for students with no previous background in the forensic sciences. However, the nature of this Forensic Science course is interdisciplinary with students from both chemistry and biology backgrounds choosing this as an elective. One of the crucial elements in this study was to determine the actual and perceived learning of concepts by the students. Actual learning was assessed with a written test (**Appendix C**) and the results of the study reveal that students’ knowledge of concepts increased significantly by the end of the semester, from a mean of 26% ( $SD = 10$ ) on pretests to 77% ( $SD = 8$ ,  $p < 0.001$ ) on post-tests constituting a normalized learning gain of 0.62 (**FIGURE 4A**).

In addition, the study also probed student familiarity with various topics discussed through the course of the semester in the form of self-reported learning (**Appendix C**). Overall, the average of the familiarity with various topics increased from 13% ( $SD = 4$ ) at the beginning of the semester to 77% ( $SD = 7$ ,  $p < 0.001$ ) at the end of the semester with an overall normalized gain of 0.74 (**Figure 4B**). The normalized learning gains ranged from 0.59 to 0.83 for different topics with the highest perceived concept gain on in-class case study discussion and in the group presentation.

**A**



**B**



**FIGURE 4** Student’s actual and perceived learning of concepts in the forensic science course. Test and survey tools are shown in **Appendix C**.

A) Student’s actual learning of concepts measured by pre- and post-written tests.

- B) Student’s perception of learning measured through a survey with questions relating to their perceived understanding of concepts.

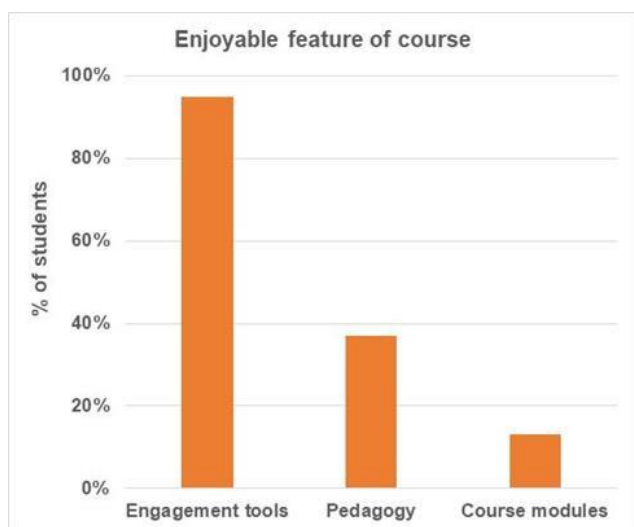
*Open-Ended Questions*

As part of the survey, students were asked open-ended questions on (a) the most enjoyable part of the course and (b) suggestions to enhance student learning and engagement in the future. Student responses to these open-ended questions were analysed and classified into distinct categories.

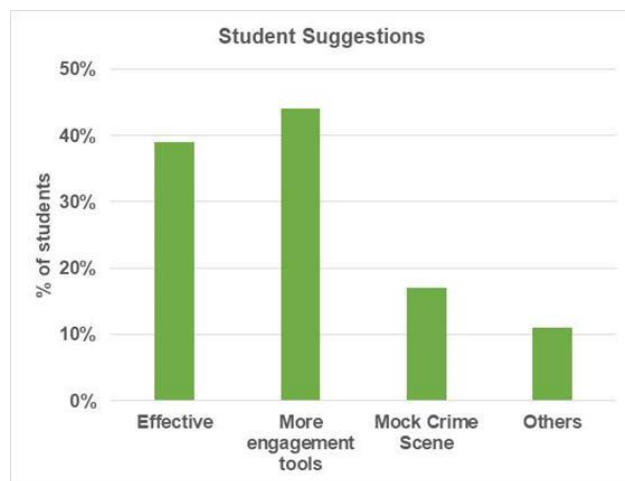
Almost all of the students participating in the survey (95%) responded that engagement tools like forensic case study discussions, Mentimeter polls and quizzes were the most enjoyable part of the course. 37% of responding students also reported that they enjoyed the interactive nature and pedagogical style adopted by the instructor in the course, while a small section (13%) preferred specific course modules like toxicology and ballistics (**FIGURE 5A**)

When asked to provide suggestions to enhance student learning and engagement in the course, 39% reported that they had no further suggestions as the course was effective in the manner it was taught (**FIGURE 5B, TABLE 1**). 44% of responding students also mentioned that more engagement tools like quizzes, polls and discussions would be effective in student engagement and learning. 17% of students suggested including a group project such as a mock crime scene analysis while 11% of students felt that there was a need for classroom upgradation and a system for rewarding students who participate.

**A.**



**B.**



**FIGURE 5** Student responses for the open-ended questions on the survey; *N* = 39.

- A) Student responses to the most enjoyable part of the course. Registered responses were analysed and classified into three distinct categories: engagement tools, pedagogy and specific course modules.
- B) Student suggestions to enhance learning and engagement. Registered responses were analysed and classified into four distinct categories: effective as is, more engagement tools, mock crime scenes and others.

**TABLE 1** Representative examples of student suggestions to enhance learning and engagement.

Category	Representative examples of student suggestions
<i>Engagement tools</i>	It would be nice if we could have more Menti polls More canvas quizzes would be great.
<i>Effective</i>	It’s actually effective the way we are engaging in class. Nothing. Everything in the course is good
<i>Mock Crime scene</i>	A suggestion would be to add a mock crime scene assignment Setting up a mock crime scene would be interesting.
<i>Others</i>	Classroom upgradation is required. System for rewarding students who participate would be good

## DISCUSSION

Previous studies have shown that comprehensive pedagogical models are required for engaging students in forensic learning (26, 27). Student engagement is a vital component of education; however, it can be quite challenging to engage the student in the classroom. In order to understand the factors influencing engagement in the classroom, this study visualizes three key modes of interaction for the student: with their content, with their peers and with the faculty in charge of the course. The goal of this study was to understand student perspectives on these modes of interaction and their effects on student engagement and learning.

Student interaction with the course content, their peers and with the faculty was determined through an analysis of student perceptions as measured by responses to survey questions. The survey results showed that students found the engagement tools used in the course to be effective and intellectually stimulating. This was also reflected in the themes that emerged in response to the open-ended questions in the survey. Students commented that these engagement tools were the most enjoyable part of the course and suggested using more of these in the future.

These engagement tools included polls, online quizzes and discussion of forensic case studies (both in class and in online forums). Incidentally, while these tools largely engage the students with the content of the course, they also reflect student interaction with their peers and the faculty. This is especially true in the case of forensic case study discussions where the students engaged in discussion with the instructor and their peers both in-class as well as in the discussion forums online.

In addition to peer interaction during discussions, the course methodology also promoted team effort through group presentations on forensic cases. As the presentation required the students to do research on the cases as a team, it ensured that there was student-student interaction beyond the classroom and through the course of the semester. This method was clearly effective as students reported that they enjoyed working as part of a team for the group presentation.

The author of this study (faculty in charge of the course) designed all of the course activities, encouraged interactive discussions in the class and moderated the online canvas forum to ensure effective engagement with the students. In addition, the author also used Socratic questioning in the in-class discussions with the students to promote learning and enhance their engagement. An interesting aspect of the survey was that almost all of the responding students reported that the course instructor encouraged interactive discussions and showed interest in their learning. This is substantiated by the responses to the open-ended questions in which students said that the pedagogical methods adopted for the course were

innovative and highly engaging. While the author of this study has prior experience with pedagogical strategies (24, 28), it is to be noted that the positive report is the perception of the students with regards to this particular faculty contributing to their engagement and learning.

The survey results indicated that the students found the Learning management system, Canvas, to be highly organized and easy to engage. The author of this study designed the platform to include all the course modules and references to ensure Canvas was an effective forum for students to engage with their course material. In addition, the online quizzes on canvas gave quick feedback and proved to be an effective assessment tool while the discussion forums ensured peer engagement beyond the classroom. Previous studies have shown Canvas to be effective for online courses during the pandemic (29, 30). This study reveals that it can be used in a face-to-face course to enable engagement and learning beyond the confines of the classroom.

One of the objectives of this study was to understand if there was an increase in actual and perceived learning in this forensic science course. Statistical analysis showed that students' knowledge of concepts increased significantly by the end of the semester based on results from pre- and post-course tests. In addition, there was a statistically significant increase in the students' perceived learning of concepts. Interestingly, this perceived learning gain ranged from 0.59 to 0.83 for different topics taught during the semester (**Appendix C**). The highest perceived gain in learning was observed for the in-class discussions of case studies and in the group presentation. Both of these methodologies involved active discussion with either the faculty/peer groups or a combination of both. Active learning methods have been shown to enhance student engagement and learning (23-24, 31). As a result, it is perceivable that the active discussion methodology used in these case studies was the reason for the perception of increased gain in learning. The lowest perceived gain as reported by the students was observed with instrumentation techniques used in forensic sciences. Currently, this course does not include a laboratory component and it is possible that a lack of hands-on training could be the reason for the student's perception of lower perceived gain in learning for instrumentation techniques. However, there are plans to incorporate a laboratory component in future semesters to address this issue.

### Limitations

This study was conducted for students registered in a forensic science course in Fall 2023. As a result, it is limited by sample size and the perspectives/experiences of the students who responded to this survey.



## Conclusions

This study shows that students perceive that interaction with the course content, their peers and the faculty in charge of the course have a positive effect on their engagement. In addition, the study also reveals an increase in actual as well as perceived learning through the course of the semester. Based on this positive experience, the author encourages other faculty in forensic sciences to involve pedagogical strategies to foster engagement and learning in the classroom.

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## References

1. Fredricks JA, Blumenfeld, PC, Paris, AH. School engagement: Potential of the concept, state of the evidence. *Rev Educ Res*2004; 74(1):59–109.
2. Kahu ER. Framing student engagement in higher education. *Stud in High Educ* 2013; 38(5):758–73.
3. Kahu ER, Nelson K. Student engagement in the educational interface: Understanding the mechanisms of student success. *High Educ Res Dev* 2018;37(1):58–71.
4. Kuh GD, Cruce TM, Shoup R, Kinzie J, Gonyea RM. Unmasking the effects of student engagement on first-year college grades and persistence. *The J High Educ* 2008;79(5):540–63.
5. Kerri- Lee K, Hamish C. Students' engagement in First- year University. *Assess Eval High Educ* 2008; 33:493-505.
6. Ginns P, Ellis R. Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning. *Internet and High Educa*2007;10(1):53–64.
7. Delialioğlu Ö. Student engagement in blended learning environments with lecture-based and problem-based instructional approaches. *Educ Tech Soc* 2012; 15(3):310–22.
8. Akers R. Resources in technology and engineering: A journey to increase student engagement. *Technol Eng Teach* 2017;76 (5): 28-32.
9. Moore MG. Three types of interaction. *Am J Dist Educ*1989; 3 (2) 1– 7.
10. Chan KW. An investigation into the CSI effect on the Malaysian population. *Aust J Forensic Sci* 2013; 45(4):417-30.
11. Maeder EM, Corbett R. Beyond frequency: Perceived realism and the CSI effect. *Can J Criminol Crim Just* 2015;57(1):83-114.
12. Weaver R, Salamonson Y, Koch J, Porter G. The CSI effect at university: forensic science students' television viewing and perceptions of ethical issues. *Aust J Forensic Sci* 2012;44 (4):381-91.
13. Illes M, Bruce C, Stotesbury T, Hanley-Dafoe R. A study on university student engagement within a forensic science course. *JMRT* 2018;1:55-70.
14. Croce KA, Elkins KM, Raje S. The power of out of school engagements: developing high school students' identities as forensic scientists. *J Forensic Sci Educ* 2023;5(1).
15. Farah K, Farnam L. Transitioning a mock crime scene for remote learning. *J Forensic Sci Educ* 2022; 4;1.
16. Fakayode SO, Mayes JP, Kanipes MI, Johnson D, Cuthbertson E. Promoting student learning in criminal justice, STEM, and forensic science: Aggie sleuth initiative (AggieSI)-guided inquiry learning experience. *J Crim Just Educ* 2018;28:1-15.
17. Novroski N, Woodall K, Clayton M. Experiential learning in forensic science at the University of Toronto Mississauga: The merits of a forensic crime scene house. *J Forensic Sci Educ* 2023;5:2.
18. Supe A, Burdick WP. Challenges and issues in medical education in India. *Acad Med* 2006; 81(12):1076-80.
19. Bhandari D, Sahajpal V, Sharma A, Arora VK. Forensic science education in India: Challenges and opportunities. *J.Forensic Sci Crim Investih* 2020; 14(2).
20. Khare A. IISERs: new initiatives towards excellence in science. *Curr Sci* 2016;110(5):763-5.
21. Martin F, Bolliger DU. Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learn J* 2018; 22(1):205-22.
22. Elder L. *The Role of Socratic Questioning in Thinking, Teaching, and Learning*. Oxfordshire, England: The Clearing House; 1998.
23. Wiggins BL, Eddy SL, Wener-Fligner L, Freisem K, Grunspan DZ, Theobald EJ, Timbrook J, Crowe AJ. ASPECT: A survey to assess student perspective of

engagement in an active-learning classroom. *LSE* 2017;16 (2), ar32.

24. Viswanathan R, Krishnamurthy N. Engaging students through active learning strategies in a medicinal chemistry course. *J Chem Educ* 2023; 100 (12):4638-43.
25. Hake RR. Interactive-engagement versus traditional methods: A six-thousand student survey of mechanics test data for introductory physics course. *Am J Phys* 1998; 66;1:64-74.
26. Kaser Tran CJ, Lamar MF. Fostering small group discussion in an online instrumental analysis course using Google Docs. *J Forensic Sci Educ* 2020;2(2).
27. Zhang M, Atta-Obeng E. Engaging students in forensic anthropology learning: A comprehensive pedagogical model. *J Forensic Sci Educ* 2023;5(2).
28. Krishnamurthy N. Teaching freshmen chemistry in India during the COVID-19 pandemic. Student perspectives and challenges. *J Chem Educ* 2021; 98(12):3884-91.
29. Gina Londino-Smolar G. Remotely teaching a large enrollment introduction to forensic science course. *J Forensic Sci Educ* 2020;2(2).
30. Krishnamurthy N. Strategies for teaching an online forensic science course during the pandemic. *J Forensic Sci Educ* 2022; 4(1).
31. Bouley R. Redesigning a one-semester biochemistry class using in-class activities to achieve high student engagement. *J Chem Educ* 2022; 99(8):2943-9.

### Appendix A

1. One of the case studies discussed in class was the gang rape/murder of a young woman in India. In the ensuing trial, the perpetrators were given the death sentence. However, one of the perpetrators (a juvenile), was given a 3-year sentence and a new identity on release.

The main question under discussion involved the following: Was this sentence fair to the victim and the criminal justice system? The interactive discussion involved the concept of law and justice and some of the Socratic questions discussed are listed below:

- a. Why did I ask the question about the fairness of the decision?
- b. How does this relate to our discussion on law and justice today?

- c. Do you agree with this verdict? Why or why not?

2. Another case discussion involved the well-publicized murder of a young girl in her home; a case that has remained unsolved until today. The police, media and the public made several initial assumptions about the young girl and the murder and there were also questions about the validity of the evidence presented. A few of the questions that were discussed included:

- a. Why would someone make these assumptions about the case and the young girl?
- b. How can you verify or disprove some of these assumptions?
- c. What are the consequences of these assumptions on the overall case?
- d. Was there any reason to question the evidence and if so, why?

### Appendix B

#### Survey Questions

For the following statements, please make your choice on a Likert scale that goes from strongly disagree, disagree, neutral, agree, and strongly agree

Question 1: The following set of questions relate to your interaction with the course material and its role in your engagement and learning. Please select ONE option for each question.

- Lectures were well organized and interactive
- Pedagogical tools like Mentimeter polls, online quizzes and discussions were engaging and intellectually stimulating
- Weekly quizzes on Canvas provided an insight into my understanding of course material
- Course material on Canvas was well organized and easy to engage
- Assessments and exams were reflective of course material and helped test my learning

Question 2: The following set of questions relate to your interaction with your peers and its role in your engagement and learning. Please select ONE option for each question.

- In-class discussions encouraged engagement with peers and fostered critical thinking
- Online discussion forums promoted engagement in forensic case studies beyond the classroom
- I enjoyed working as part of a team for my group presentation.



Question 3: The following set of questions relate to the contribution of the faculty-in charge to your course engagement and learning. Please select ONE option for each question.

- The faculty was well prepared and explained the material well
- The faculty encouraged interactive discussions and student engagement
- The faculty showed interest in my learning

**Open-ended questions: Please share your thoughts in the space provided**

- What was the most enjoyable part of the course?
- What suggestions can you provide to enhance student learning experience/engagement in this course?

**Closed-ended question: For the following question, please circle one choice**

Gender:

- Male
- Female
- Prefer not to say

## Appendix C

### Student Learning

List of questions for pre- and post-test:

1. I make the following statement: "Forensic Science is the application of medical knowledge to establish the causes of injury or death". Is this correct? Justify your answer.
2. What is the difference between law and justice?
3. At a crime scene, several pieces of evidence are usually collected. A single item of evidence usually comes into contact with several people. What is this list of all people who have come into possession of an item of evidence called?
4. A rumour circulates that the drinking water in a restaurant is contaminated with chromium. You work in a research institute with advanced instrumentation. Name a technique you could use to test the water for chromium?
5. What is *rigor mortis*?
6. What is a "staged crime scene"?
7. What is STR and what is this method of analysis used for?
8. The death of an individual to chronic alcoholism is called \_\_\_\_\_.
9. What is *Locard's principle*?

Survey for perceived learning of concepts

For each of the following statements, please rate your familiarity (unfamiliar or familiar) at the beginning of the course as well as the end of the course.

- The case studies I engaged in interactive sessions during class
- The case studies I engaged in the discussion forums
- Subject of my group presentation
- Conducting an appraisal of a crime scene; including the recognition, collection, identification, preservation and documentation of physical evidence
- Understanding the forensic science of DNA, blood, toxicology, narcotics, fingerprinting, hair and fibre analysis etc.
- Familiarity with advanced instrumentation techniques used in forensic science
- Correlating knowledge of forensic science towards application to the legal system.
- Applying the scientific method and using critical thinking to solve problems in a mock crime scene.